GROUNDWATER INVESTIGATION
DOWNTOWN MONTESANO
MONTESANO, WASHINGTON

AUGUST 5, 2005

FOR
WASHINGTON STATE DEPARTMENT OF ECOLOGY

File No. 0504-024-00

Groundwater Investigation
File No. 0504-024-00

August 5, 2005

Prepared for:

Washington Department of Ecology
Toxics Cleanup Program
Southwest Regional Office
P.O. Box 47775
Olympia, Washington 98504-7775

Attention: Marv Coleman

Prepared by:

GeoEngineers, Inc.
1101 Fawcett Avenue, Suite 200
Tacoma, Washington 98402
(253) 383-4940

GeoEngineers, Inc.

Tony C. Mathis, PE, LG, LHG
Environmental Engineer

John H. Biggane, LG, LEG, LHG
Principal

TCM:JHB:tt
TACO:\0\0504024\00\Finals\050402400R.doc

TABLE OF CONTENTS

Page No.

1.0 INTRODUCTION 1
1.1 PROJECT AREA DESCRIPTION 1
1.2 PROJECT AREA HISTORY 1
1.3 PROJECT PURPOSE AND SCOPE 1
1.3.1 Task 1 – Review 2
1.3.2 Task 2 – Develop Site Model and Identify Data Gaps 2
1.3.3 Task 3 – Develop SAP 3
1.3.4 Task 4 – Implement the SAP 3
1.4 SAMPLING METHODS 4

2.0 PROJECT AREA BACKGROUND 5
2.1 CONTAMINANTS OF CONCERN 5
2.2 PREVIOUS CONSTRUCTION ACTIVITIES 5
2.3 PREVIOUS INVESTIGATIONS/SITE WORK 5

3.0 RESULTS – CONCEPTUAL SITE MODEL 6
3.1 GENERAL 6
3.2 POTENTIOMETRIC SURFACE 6
3.3 CHEMICAL ANALYTICAL DATA 6
3.3.1 Soil 7
3.3.2 Groundwater 8
3.4 CONTAMINANT SOURCES/OVERALL EXTENT 9
3.4.1 Brumfield-Twidwell 10
3.4.2 GH Grange/Tony's Short Stop 10
3.4.3 Key Bank (Sterling)/Whitney's Inc. 10
3.4.4 Picco's Standard/Pontiac Richfield 10
3.4.5 Pinger's Texaco/Allison's 11
3.5 CONTAMINANT PATHWAYS 11

4.0 RECOMMENDATIONS 11
4.1 GENERAL 11
4.2 METHODS/SEQUENCING 12
4.2.1 Geophysical Techniques 12
4.2.2 Direct Push – Soil Vapor Sampling 12
4.2.3 Direct Push – Soil and Groundwater Sampling 12
4.3 AREAS FOR FURTHER INVESTIGATION 13
4.3.1 Brumfield-Twidwell 13
4.3.2 GH Grange/Tony's Short Stop 13
4.3.3 Whitney's Inc./Key Bank (Sterling) 13

5.0 CONCLUSIONS 13
5.1 GENERAL 13

TABLE OF CONTENTS (CONTINUED)

Page No.

List of Tables

Table 1. Summary of Chemical Analytical Data Results for Petroleum Hydrocarbons in Soil
Table 2. Summary of Chemical Analytical Data Results for Petroleum Hydrocarbons in Groundwater

List of Figures

Figure 1. Vicinity Map
Figure 2. Completed Borings
Figure 3. Conceptual Model
Figure 4. Potentiometric Surface Map
Figure 5. Petroleum Impacted Areas - Soil Concentrations
Figure 6. Petroleum Impacted Areas - Groundwater Concentrations
Figure 7. Proposed Future Investigation Locations

APPENDICES

APPENDIX A – SAMPLING AND ANALYSIS PLAN
APPENDIX B – EXPLORATION LOGS

Appendix B Figures

Figure B-1. Key to Exploration Logs
Figures B-2 through B-33. Log of Borings

APPENDIX C – ANALYTICAL DATA QA/QC SUMMARY AND CHEMICAL ANALYTICAL DATA REPORTS ..... C-1...C-2
APPENDIX D – REPORT LIMITATIONS AND GUIDELINES FOR USE ..... D-1…D-3

GROUNDWATER INVESTIGATION
DOWNTOWN MONTESANO
MONTESANO, WASHINGTON
FOR
WASHINGTON STATE DEPARTMENT OF ECOLOGY

1.0 INTRODUCTION

1.1 PROJECT AREA DESCRIPTION

The project area is located within the City of Montesano. Montesano is located on Highway 12, approximately 10 miles east of Aberdeen, Washington. The downtown area is situated on the north side of a valley containing Smith Canal. The ground surface slopes gently downward to the south toward Smith Canal. Groundwater appears to flow southeastward toward the canal. The location of the Project Area is indicated on the Vicinity Map, Figure 1.

1.2 PROJECT AREA HISTORY

Multiple service stations and other petroleum-product handling facilities existed in the downtown Montesano area from the early 20th century until 1967, when U.S. Highway 12 (US 12) was relocated from along Pioneer Avenue to the current highway alignment just south of the downtown area. Many of the facilities closed around the time of the relocation of U.S. 12, with many USTs suspected of being left in place, possibly with product still in them.

In the late 1980s, the City of Montesano replaced its gravity-flow sanitary sewer system with a pressurized "step-up" system. Petroleum-related contaminants are suspected to exist in the City's old and new sewer systems, and may also be present in the City's storm-drainage system. These utility corridors may be providing preferential pathways for petroleum-related contamination to spread from downtown Montesano towards the waterway to the south.

The Project Area includes multiple sites as indicated on Figure 2. Sites that Ecology has identified as having known releases include Key Bank (Sterling), Jackpot Station 392, P.J. MaxiMart, Grays Harbor County Shops (GH County), Tony's Short Stop, Brumfield-Twidwell, Grays Harbor Grange (GH Grange) and two sites at the City of Montesano Shop. Additional sites suspected of having been former service stations and other petroleum-handling facilities were identified as candidates for additional research. The locations of the sites with known or suspected releases are shown on Figure 2.

The Department of Ecology has proposed evaluating the downtown Montesano area as a single integrated site to evaluate the overall effects of contaminant source areas, nature and extent of contamination and migration pathways of groundwater contamination.

1.3 PROJECT PURPOSE AND SCOPE

The project approach was developed as four integrated tasks that began with reviewing readily available data about the Project Area. The remaining tasks consisted of developing a site model, developing a Sampling and Analysis Plan (SAP) and implementing the SAP. This report presents the results of the site activities and provides our interpretation of conditions in the Project Area and recommendations for future exploration activities. The specific scope of services performed for Tasks 1 through 4 is described below.

1.3.1 Task 1 – Review

The purpose of this task was to further our understanding of the general setting of the Project Area and to categorize specific parcels within the Project Area as properties with known contamination, properties with suspected contamination, properties not having any known history of contamination, and parcels about which little or no information was available. Specific actions performed as part of Task 1 included:

1. Reviewed current USGS topographic and geological maps to identify the physiographic setting of the Project Area.
2. Reviewed Ecology's files regarding parcels at the Project Area, including independent LUST site reports, VCP site reports, Ecology hazardous waste inspection reports and the results of Ecology's semi-annual groundwater sampling events of October 2004 and April 2005.
3. Reviewed historical aerial photos, fire insurance maps, and city directories to identify past development history for parcels with limited-information within the Project Area relative to the possible use, generation, storage, release or disposal of hazardous substances.
4. Interviewed individuals that have knowledge of past land use and contaminant-related activities.
5. Reviewed available utility maps, geotechnical, historical and environmental reports and/or other relevant documents pertaining to environmental conditions and groundwater flow and contaminant transport at the Project Area.
6. Developed a GIS/database system for the Project Area and summarized the information obtained from this review to classify available data, and identify areas that have low-quality, limited or no data.

1.3.2 Task 2 – Develop Site Model and Identify Data Gaps

We identified areas with existing data gaps and developed a working conceptual model of the Project Area that generally described the nature and extent of petroleum-related contamination across the Project Area. The model identified where parcel-specific data is adequate, minimal or nonexistent. We utilized data-gathering resources beginning with those that provided broad information about limited-information parcels and used more specific data-gathering techniques as appropriate to identify which of those areas required further investigation. Site information was put in the form of a GIS/database system that delineates areas where groundwater monitoring wells are few or of unknown or improper construction. Our specific scope of services for Task 2 was as follows:

1. Attempted to identify the possible use, generation, storage, release or disposal of hazardous substances on parcels about which little or no information was found during Task 1.
2. Attempted to identify the use of those parcels from the present to the time that records show no apparent development of the site, or to 1940, whichever is earlier.
3. Conducted telephone interviews of representatives of the local fire department regarding the history of limited-information parcels relative to the likely presence of hazardous substances.
4. Where appropriate, conducted interviews of key property managers within the Project Area with specific knowledge of past and present parcel use.
5. Described the known nature and extent of petroleum contamination across the Project Area, and delineated the areas of the Project Area where limited or no data is available

6. Developed maps that indicate groundwater elevations and flow directions across the Project Area, and identify man-made features such as utility corridors or building foundations that may affect groundwater flow directions.
7. Prepared a conceptual model of the Project Area that uses flowlines and isocontours to generally describe groundwater flow and contaminant distribution across the Project Area and identify likely contaminant pathways.

1.3.3 Task 3 – Develop SAP

We prepared a SAP in accordance with Washington Administrative Code (WAC) 173-340-820 that addressed the data gaps and confirmed the conceptual model. The SAP presented the rationale for the approach and the specific scope of services to investigate Project Area conditions, including the collection soil and groundwater samples. The SAP is included as Appendix A. A Health and Safety Plan was prepared in accordance with WAC 296-843-12005 also. We anticipated the investigation would consist of approximately 36 "direct-push" borings to depths of up to 25 feet below existing ground surface (bgs). A total of 32 direct-push borings were completed.

The SAP was submitted to Ecology for review and comment on May 3, 2005. We met with Ecology on May 9th to discuss the SAP and resolved any questions or concerns regarding the approach and scope of the sampling activities. We modified the plan to address any questions or concerns before finalizing the SAP based on the results of this meeting.

1.3.4 Task 4 – Implement the SAP

Implement the final SAP and prepare this draft report of the investigation for review by Ecology. This work included the following:

1. Visited the Project Area to field mark exploration locations as required by the One Call utility locating service and contacted the One Call utility locating service as required by state law. In addition, we subcontracted a private utility locator to perform locating work at the Project Area. We attempted to locate as many explorations as possible on public property. We coordinated our own traffic control for explorations located in street right-of-ways.
2. Advanced approximately 32 direct-push borings to depths as great as 25 feet bgs within the City of Montesano using a drill rig under subcontract to GeoEngineers.
3. Collected as many as three soil samples per boring for submittal to North Creek Analytical Laboratories in Bothell, Washington (NCA). We also collected one groundwater sample per boring, if groundwater was present, for submittal to an Ecology representative on site. The soil samples were placed in appropriately sized glass jars. Water samples were collected, using low-flow techniques, into three 40 mL HCl-preserved VOA vials. Ecology submitted the samples to Manchester Laboratories for analysis by NWTPH-Dx, -Gx and BTEX.

The exact number of borings changed based on the results of Tasks 1 through 3 and field observations during drilling activities. Thirty-six borings were originally proposed, however field observations indicated some of the proposed borings were located in areas where finding contamination was either unlikely or confirmed to the extent that no further exploration was necessary.

We performed the following activities after the field work was completed, and the analytical data were received from NCA and Manchester Laboratories:

1. Compared the analytical results with appropriate MTCA cleanup levels.
2. Updated the GIS/database system.
3. Compared the information obtained from the field program and updated and/or revised the site conceptual model as appropriate.
4. Prepared this report that includes:
   - Methods of current investigation
   - Results of the investigation, including summary data tables
   - Data interpretation/Conceptual Site Model
   - Illustrations: groundwater elevation maps, contaminant source, pathways and distribution maps
   - Recommendations for further action, including future locations of permanent groundwater monitoring wells and any additional sites to be investigated
   - Conclusions.

1.4 SAMPLING METHODS

The May 2005 groundwater investigation consisted of advancing 32 direct-push borings at selected locations, as shown on Figure 2. Drilling and sampling activities consisted of the following:

1. Advanced 32 direct-push borings to depths as great as 25 feet bgs throughout the Project Area. Borings were often located as close as possible to City of Montesano's sewer utility lines to assess the likelihood of utility corridors acting as preferential migration pathways for contaminants. The borings were continuously sampled, and logged in the field by a qualified individual using procedures described in the SAP.
2. Performed field screening of soil from the borings. Field-screening techniques included water sheen testing, headspace vapor testing (PID), and visual and olfactory observations for unusual colors or petroleum odors, respectively.
3. Collected as many as three soil samples from each boring. The depth from which samples were collected was based upon field screening and the depth to the groundwater table. Soil samples were collected in 4-ounce jars appropriate for soil sampling and immediately placed in a cooler with ice. Samples were labeled such that the boring number, sample number and sample depth are apparent, for example: SP-1-2-12.5.
4. Measured depth-to-groundwater and collected one groundwater sample when groundwater was present from each boring after completion of drilling. Samples were collected using "low-flow" technique. The samples were collected into three HCl preserved (1 to 1) 40-mL VOAs. The groundwater samples were placed in a cooler with ice. Groundwater elevations were determined by referencing ground surface elevation of each boring based on maps provided by the City of Montesano.
5. Followed chain-of-custody procedures described in the SAP and transferred soil samples to NCA for analysis by NWTPH-Gx, -Dx and BTEX. Groundwater samples were transferred to an on-

site Ecology representative, who submitted samples to Manchester Laboratories, Inc. for analysis by NWTPH-Gx and BTEX.

Two representatives from GeoEngineers coordinated and observed the drilling activities. GeoEngineers maintained a detailed log of soil and groundwater conditions encountered within each boring and mapped the location of each boring in the field. Soil was classified in general accordance with American Society for Testing and Materials (ASTM) D 2488. The field screening results and soil classification were recorded on the boring logs, included in Appendix B. Known site features were used as references to map the locations of borings.

2.0 PROJECT AREA BACKGROUND

2.1 CONTAMINANTS OF CONCERN

The primary contaminants of concern at the Project Area are gasoline-range hydrocarbons. This information is based on prior Ecology investigations and historic records pertaining to the former service stations and/or petroleum-product handling facilities. Other contaminants of concern may be present at the Project Area, but were not included in this investigation.

2.2 PREVIOUS CONSTRUCTION ACTIVITIES

The City of Montesano abandoned its gravity-flow sanitary sewer system and installed a pressurized "step-up" system in the late 1980s. The new and abandoned systems were the focus of the groundwater investigation to evaluate potential source and contaminant pathway(s) for gasoline-range hydrocarbons.

2.3 PREVIOUS INVESTIGATIONS/SITE WORK

Monitoring wells have been installed at or around sites with known releases, including Key Bank (Sterling), Jackpot Station 392, GH County, P.J. MaxiMart, Tony's Short Stop, Brumfield-Twidwell, GH Grange, and one site at the City of Montesano Shop. Ecology has performed groundwater sampling and analysis at these sites. The results of these sampling events indicate the presence of petroleum hydrocarbon-related contamination at concentrations greater than MTCA Method A cleanup levels during at least one sampling event in at least one well at each of these sites except at the GH County site.

Several sites are known to have had USTs removed or closed-in-place prior to this investigation. These locations include Jackpot Station 392, Picco's Standard, Boyer's Phillips, Mobile, GH County, GH Grange, Brumfield-Twidwell, Telephone Utility, Whitney's Inc., Fire Hall, City of Montesano Shop, Monte Square Enterprise and Smith Tractor. Limited exploration or remedial excavation activities occurred at the following locations, as documented in Ecology's files:

- Whitney's Inc. – August 1995
- Fire Hall – 1995 and 2000
- City of Montesano Shop – 1990 and 1999
- Monte Square Enterprise – 1996

The results of some of the limited explorations or remediation are inconclusive based on the documentation presently available. Other locations may have had limited exploration or remediation performed but no documentation has been provided regarding information related to exploration or

remediation activities. Additional work will be appropriate to obtain more conclusive information regarding the results of these activities

3.0 RESULTS – CONCEPTUAL SITE MODEL

3.1 GENERAL

The conceptual model for the Project Area consists of petroleum releases from three potential source area sites in downtown Montesano which has resulted in soil and groundwater contamination, including the presence of petroleum product as light non-aqueous phase liquid (LNAPL or free phase petroleum product) and dissolved phase petroleum-related contaminants. The data indicate the presence of petroleum-related contamination at concentrations far greater than MTCA Method A cleanup levels at these three sites.

In addition, at least two sites have potential residual petroleum contamination associated with them. UST removal and cleanup is known or suspected to have occurred at these potential residual contamination sites, and chemical analytical data indicate the presence of weathered petroleum-related contamination at these sites. In addition, the data indicate that concentrations of petroleum-related contamination at these potential residual contamination sites are only slightly greater than (or in some cases less than) MTCA Method A cleanup levels for various contaminants.

Contamination is being mobilized from soil into groundwater by rainwater infiltrating into site soils, or by seasonal changes in groundwater elevations which allow petroleum-related contamination in soil to dissolve into groundwater. Groundwater containing dissolved phase petroleum hydrocarbons is migrating generally in a southeast direction across the downtown area of Montesano. See Figure 3.

The direction and rate of the groundwater flow across the Project Area may be affected by current and abandoned sanitary sewer lines and other underground utility corridors. These underground corridors may serve as subsurface drains, collecting and changing the direction and rate of groundwater flow. The conceptual model envisions groundwater flow being collected by these subsurface corridors with some portion of the total groundwater flow from the site discharging along these corridors to Smith Canal.

3.2 POTENTIOMETRIC SURFACE

Groundwater elevations observed during this investigation support the reported southeasterly groundwater gradient, as indicated on Figure 4. Figure 4 was generated by applying a geostatistical gridding method known as *Kriging* to the groundwater elevation data points observed during field activities. *Kriging* produces visually appealing maps from irregularly spaced data. It also attempts to express trends suggested in data, so that, for example, high points are connected along a ridge rather than isolated by bull's-eye type contours.

Figure 4 should be interpreted to be a general gradient for the Project Area, as the number of data points does not permit high resolution. The surface can also be expected to fluctuate both locally and on an area-wide basis during different seasons of the year.

3.3 CHEMICAL ANALYTICAL DATA

Analytical data QA/QC summary is attached as Appendix C followed by chemical analytical data reports.

3.3.1 Soil

Fifty-seven soil samples that were collected from Borings SP-01 through SP-32 were submitted for analysis of petroleum hydrocarbons and BTEX. The results of the soil analysis are presented in Table 1 and are summarized as follows:

- Gasoline-range hydrocarbons and BTEX were not detected in 30 soil samples.
- Gasoline-range hydrocarbons were detected at concentrations less than MTCA Method A cleanup levels in soil samples collected from depths ranging between 15 to 17 feet bgs in Boring SP-08. This boring is located at the Boyer's Phillips site.
- Gasoline-range hydrocarbons were detected at concentrations greater than MTCA Method A cleanup levels in soil samples collected from depths ranging between 0 to 17 feet in Borings SP-07, SP-10, SP-22, SP-25, SP-26, SP-27, SP-29 and SP-31. These borings are located at the Pontiac Richfield, Brumfield-Twidwell, Picco's Standard, Key Bank (Sterling), Whitney's Inc. and GH Grange sites, and south across Pioneer Avenue from the Pinger's Texaco and Allison's sites.
- Benzene was detected in soil samples collected from depths ranging between 0 to 17 feet bgs in Borings SP-10, SP-15, SP-16, SP-19, SP-21, SP-22 and SP-25 through SP-29 at concentrations ranging from 0.0385 mg/kg to 20.9 mg/kg. The Method A unrestricted land use (ULU) cleanup level for benzene is 0.03 mg/kg.
- Toluene was detected in soil samples collected from depths of about 0 to 17 feet bgs in Borings SP-10, SP-15, SP-19, SP-21, SP-22, SP-25, SP-26, SP-27, SP-28 and SP-29 at concentrations ranging from 0.0443 mg/kg to 19.2 mg/kg. The Method A ULU cleanup level for toluene is 7 mg/kg. The Method A cleanup level for toluene is 1,000 ug/L. The concentration of toluene detected in soil samples from Borings SP-25 through SP-29 exceeded the Method A cleanup level.
- Ethylbenzene was detected in soil samples collected from depths of about 0 to 17 feet bgs in Borings SP-07, SP-10, SP-22, SP-25, SP-26, SP-27, SP-28 and SP-29 at concentrations ranging from 0.0566 mg/kg to 218 mg/kg. The Method A ULU cleanup level for ethylbenzene is 6 mg/kg. The concentration of ethylbenzene detected in soil samples from Borings SP-10 and SP-25 through SP-27 exceeded the Method A cleanup level.
- Xylenes were detected in soil samples collected from depths of about 0 to 17 feet bgs in Borings SP-03, SP-07, SP-09, SP-10, SP-15, SP-19, SP-22, SP-25, SP-26, SP-27, SP-28 and SP-29 at concentrations ranging from 0.113 mg/kg to 894 mg/kg. The Method A ULU cleanup level for xylenes is 9 mg/kg. The concentration of xylenes detected in soil samples from Borings SP-10, SP-25 through SP-27 and SP-29 exceeded the Method A cleanup level.
- Diesel-range hydrocarbons were not detected in 42 soil samples.
- Diesel-range hydrocarbons were detected at concentrations less than MTCA Method A cleanup levels in soil samples collected from depths of about 0 to 17 feet bgs in Borings SP-03, SP-10, SP-12, SP-25, SP-31 and SP-32.
- Diesel-range hydrocarbons were detected at concentrations greater than MTCA Method A cleanup levels in one soil sample collected at ground surface in Boring SP-26. This is at the Brumfield-Twidwell site.
- Lube oil-range hydrocarbons were not detected in 53 soil samples.

- Lube oil-range hydrocarbons were detected in soil samples collected from depths of about 0 to 17 feet bgs in Borings SP-12, SP-26 and SP-32 at concentrations ranging from 74.6 mg/kg to 1,560 mg/kg.

Petroleum-impacted soils were encountered primarily in the vicinity of the following locations, shown on Figure 5:

- Brumfield-Twidwell
- Whitney's Inc./Key Bank (Sterling)
- Tony's Short Stop/GH Grange
- Picco's Standard/Pontiac Richfield
- Pinger's Texaco/Allison's

Petroleum hydrocarbons were detected at concentrations greater than MTCA Method A cleanup levels in soil samples collected from the above locations.

3.3.2 Groundwater

Thirty-seven groundwater samples collected from Borings SP-1 through SP-8, SP-10 through SP-22 and SP-24 through SP-32 were submitted for analysis of gasoline-range petroleum hydrocarbons and BTEX. Four of the samples were duplicate samples and three of the samples were equipment rinseate samples. The chemical analytical results from groundwater samples collected and analyzed during the investigation are presented in Table 2 and are summarized as follows:

- Gasoline-range hydrocarbons and BTEX were not detected in 20 groundwater samples.
- Gasoline-range hydrocarbons were detected at concentrations less than MTCA Method A cleanup levels in groundwater samples collected from depths of approximately 14 feet bgs from Borings SP-07 and SP-15. These borings are located at the Pontiac Richfield and Whitney's Inc./Key Bank (Sterling) sites.
- Gasoline-range hydrocarbons were detected at concentrations greater than MTCA Method A cleanup levels in groundwater samples collected from depths ranging between 10 to 15 feet bgs from Borings SP-08, SP-10 and SP-25 through SP-29. These borings are located at the Boyer's Phillips, Brumfield-Twidwell, Whitney's Inc./Key Bank (Sterling) and GH Grange/Tony's Short Stop sites.
- Benzene was detected in groundwater samples collected from Borings SP-10, SP-25 through SP-29 and SP-31 at concentrations ranging from 1 ug/L to 22,000 microgram per liter (ug/L). The Method A cleanup level for benzene is 5 ug/L. The concentration of benzene detected in groundwater samples from Borings SP-10 and SP-25 through SP-29 exceeded the Method A cleanup level.
- Toluene was detected in groundwater samples collected from Borings SP-10, SP-25 through SP 29 and SP-31 at concentrations ranging from 2.2 ug/L to 25,200 ug/L. The Method A cleanup level for toluene is 1,000 ug/L. The concentration of toluene detected in groundwater samples from Borings SP-25 through SP-29 exceeded the Method A cleanup level.
- Ethylbenzene was detected in groundwater samples collected from Borings SP-7, SP-8, SP-10, SP-15 and SP-25 through SP-29 at concentrations ranging from 1.3 ug/L to 3,900 ug/L. The Method A cleanup level for ethylbenzene is 700 ug/L. The concentration of ethylbenzene

detected in groundwater samples from Borings SP-25 through SP-29 exceeded the Method A cleanup level.

- m & p- Xylene was detected in groundwater samples collected from Borings SP-7, SP-8, SP-10, and SP-25 through SP-29 at concentrations ranging from 2.5 ug/L to 10,700 ug/L. o- Xylene was detected in groundwater samples collected from Borings SP-7, SP-8, SP-10, SP-15 and SP-25 through SP-29 at concentrations ranging from 1.1 ug/L to 7,300 ug/L. The Method A cleanup level for total xylenes is 1,000 ug/L. The concentration of xylenes detected in groundwater samples from Borings SP-10 and SP-25 through SP-29 exceeded the Method A cleanup level.

Petroleum-impacted groundwater is present at the following locations, shown on Figure 6:

- Brumfield-Twidwell
- Key Bank (Sterling)/Whitney's Inc.
- GH Grange/Tony's Short Stop
- Boyer's Phillips

Petroleum hydrocarbons were detected at concentrations greater than MTCA Method A cleanup levels in groundwater samples collected from the above locations.

3.4 CONTAMINANT SOURCES/OVERALL EXTENT

Figures 5 and 6 show the distribution of contaminants encountered in the downtown Montesano area. The chemical analytical data indicate there are three potential contaminant source areas and two potential residual contamination areas in the downtown Montesano area. The potential source areas are shown on Figures 5 and 6 and are as follows:

- Brumfield-Twidwell
- GH Grange/Tony's Short Stop
- Key Bank (Sterling)/Whitney's Inc.

These three potential source areas may represent areas that contribute contamination to the regional groundwater contamination existing in the downtown Montesano area.

The potential residual contamination areas are shown on Figures 5 and 6 and are as follows:

- Picco's Standard/Pontiac Richfield
- Pinger's Texaco/Allison's

These two residual contamination areas do not appear to represent source areas that contribute contamination to the regional groundwater contamination existing in the downtown Montesano area.

The chemical analytical data indicate many of the other "suspected" sites do not appear to represent source areas that contribute contamination to the regional groundwater contamination existing in the downtown Montesano area.

We did not develop a groundwater isoconcentration map for the Project Area. Prior to this investigation it was suspected many sites may be contributing contaminants in downtown Montesano, however our evaluation of the data indicates the presence of only three contaminant source areas. In our opinion, a computer model-derived groundwater isoconcentration map might inaccurately reflect contaminant distribution within the Project Area.

3.4.1 Brumfield-Twidwell

The Brumfield-Twidwell site contains the highest concentrations of petroleum-related contamination in soil within the Project Area. Gasoline-range petroleum hydrocarbons were not detected in soil and groundwater samples collected from Borings SP-11 and SP-12. These borings are located downgradient of the "suspected" Fire Hall and Mobile sites. SP-11 and SP-12 are located upgradient of the Brumfield-Twidwell site, indicating a potential on-site contamination source at the Brumfield-Twidwell site. Additional information is necessary to evaluate the potential for off-site migration of petroleum contamination from the Brumfield-Twidwell site. Additional recommended exploration activities for this site are described in Section 4.0.

3.4.2 GH Grange/Tony's Short Stop

The highest concentrations of petroleum-related contamination in groundwater within the Project Area were found at the GH Grange/Tony's Short Stop site. Gasoline-range petroleum hydrocarbons were not detected in soil and groundwater samples collected from Boring SP-6, located upgradient from the GH Grange and Tony's Short Stop sites. The presence of gasoline-range petroleum contamination, however, in soil and groundwater samples collected from Borings SP-28 and SP-29, located at the GH Grange site, indicate a potential on-site contamination source at the GH Grange or a potential upgradient source at the Tony's Short Stop site.

At the time of this investigation, it was not possible to install a boring on the south side of the Tony's Short Stop site due to utility and traffic conflicts. Additional information is necessary regarding the source of petroleum-related contamination, and the potential off-site migration of petroleum-related contamination from the GH Grange and Tony's Short Stop sites. Additional recommended exploration activities for these sites are described in Section 4.0.

3.4.3 Key Bank (Sterling)/Whitney's Inc.

Gasoline-range petroleum hydrocarbons were not detected in soil and groundwater samples collected from Borings SP-13 and SP-16. These borings are located upgradient from the Key Bank (Sterling) and Whitney's Inc. sites. The presence of gasoline-range petroleum contamination, however, in soil and groundwater samples collected from Boring SP-27 and the presence of gasoline-range petroleum contamination at concentrations less than MTCA Method A cleanup levels in the groundwater sample collected from Boring SP-15 indicate a potential on-site source for petroleum contamination at the Whitney's Inc. and/or Key Bank (Sterling) sites. Additional information is necessary regarding the source of petroleum contamination, and the potential off-site transportation of petroleum contamination from the Key Bank (Sterling) and Whitney's Inc. sites.

3.4.4 Picco's Standard/Pontiac Richfield

Gasoline-range petroleum hydrocarbons were detected at concentrations greater than MTCA Method A cleanup levels in soil samples collected from Borings SP-07 and SP-22. These borings are located at the Pontiac Richfield and Picco's Standard sites, respectively.

We understand underground storage tank(s) have been removed from the Picco's Standard site. Additionally, chemical analytical data of soil samples collected from Borings SP-07 and SP-22 are indicative of residual hydrocarbon contamination. Gasoline-range petroleum contamination was present at concentrations slightly greater than MTCA Method A cleanup levels in the soil sample collected from Boring SP-22. Benzene was not detected in the soil sample collected from Boring SP-07.

3.4.5 Pinger's Texaco/Allison's

Gasoline-range petroleum hydrocarbons were detected at concentrations greater than MTCA Method A cleanup levels in one soil sample collected from Boring SP-31. This boring is located south across Pioneer Avenue from the Pinger's Texaco/Allison's sites. Concrete saw marks on the pavement at the Allison's site indicate the possible removal of (an) UST(s). The concentration of gasoline-range petroleum contamination in the soil sample collected from Boring SP-31 (slightly greater than MTCA Method A cleanup levels) is indicative of residual hydrocarbon contamination. Benzene was not detected in the soil sample.

3.5 CONTAMINANT PATHWAYS

Areas near the Brumfield-Twidwell, Whitney's Inc./Key Bank (Sterling) and GH Grange/Tony's Short Stop sites are contributing some of the highest concentrations of gasoline-range petroleum hydrocarbons at the Project Area. Gasoline-range hydrocarbons may be migrating through or along current and/or abandoned sanitary sewer utility corridors near these sites. Gasoline-range petroleum contamination was detected at concentrations greater than MTCA Method A cleanup levels in soil or groundwater samples collected from Borings SP-31 and SP-27, for example. These borings are located adjacent to sewer utilities, and downgradient of known or suspected sites. Gasoline-range contamination was not detected in Borings SP-06 and SP-14. These borings are located downgradient or crossgradient from sites known to have had petroleum releases; however, they are not adjacent to sewer utility corridors.

Information available regarding the new Step sanitary sewer system indicates that the pipeline grade and bedding material for the sewer is typically above the water levels observed during this investigation. Accordingly, it is our opinion that preferential migration of petroleum hydrocarbons from historic releases in the Site Area is not likely along the alignment of the Step system.

However, the piping elevations of the older gravity sewer system are not well documented, and it is possible that the pipe elevations and/or bedding material elevations will intersect the water table. Groundwater may potentially inflow and infiltrate (I&I) into the old gravity sewer system piping, which would allow petroleum hydrocarbons to migrate as base flow within the pipeline. It is also possible for bedding materials of the older sewer system to provide a preferential pathway for groundwater flow. In addition, storm drains, gas lines, water lines and other utility corridors that contain permeable bedding material that intersects the water table may also serve as potential migration pathways for transport of petroleum hydrocarbons in groundwater.

4.0 RECOMMENDATIONS

4.1 GENERAL

Areas that require further investigation to quantify the nature and extent of petroleum-related contamination include the Brumfield-Twidwell, GH Grange/Tony's Short Stop and Key Bank (Sterling)/ Whitney's Inc. sites (Figure 7). Our proposed methods for further investigation include geophysical as well as geo-environmental techniques as described below. We envision a sequence that begins with

geophysical methods, which will quickly and effectively identify the potential presence of USTs. After identification of the locations of potential USTs, we recommend using direct-push technology to collect soil vapor, soil and groundwater samples.

In addition, water samples should be collected from the old gravity sewer system and outfalls to evaluate the possibility of petroleum hydrocarbon contamination within the old gravity sewer system. Samples should be collected at end-of-pipe outfalls where the system discharges into surface water bodies and also from locations within the pipeline where contaminant infiltration is suspected to be occurring.

We also recommend air sampling in the basements of buildings at or near the potential contaminant source areas to characterize the concentration of contaminants in basement air.

We recommend that future Project Area work also include historical/anecdotal research of sites where limited exploration or remediation activities occurred or are suspected to have occurred.

4.2 METHODS/SEQUENCING

4.2.1 Geophysical Techniques

We recommend first using ground penetrating radar (GPR) at appropriate sites (discussed in Section 4.3), to investigate the possible existence of USTs. A GPR survey is capable of detecting both metallic and non-metallic targets. GPR data can be collected at different frequencies, with frequency selection depending on the desired resolution, depth of investigation and site conditions. We recommend field testing a 50 MHz and a 100 MHz survey over areas where USTs are suspected to exist. Both frequencies are capable of detecting large subsurface objects at different resolutions. The resolution of the 100-MHz antenna is approximately 3 feet with a maximum investigation depth of approximately 15 to 30 feet. The 50MHz antenna is capable of penetrating depths exceeding 50 feet with approximately 6-foot resolution. A 1-foot sampling interval used along the GPR lines will provide a continuous record of the subsurface.

4.2.2 Direct Push – Soil Vapor Sampling

After potential UST locations are identified, we recommend using direct-push technology as close as possible to suspected USTs. Soil vapor sampling can be accomplished using Summa canisters during this part of the investigation. Soil vapor sampling can be used as a fast screening method to optimize selection of boring locations for soil and groundwater sampling. Soil vapor samples will be analyzed using EPA Methods TO-3 and TO-15 for gasoline-range hydrocarbons and volatile organic compounds (VOCs), respectively. .

Air in the basements of buildings can be sampled using Summa canisters to evaluate concentrations of contaminants of concern over a specified time period, typically 24 hours. The data objective for building air sampling is to characterize the concentration of contaminants in building basements to identify any potential health concerns in these areas.

4.2.3 Direct Push – Soil and Groundwater Sampling

Results from GPR and soil vapor sampling methods can be used to determine the location of additional borings for collection of soil and groundwater samples.

4.3 AREAS FOR FURTHER INVESTIGATION

4.3.1 Brumfield-Twidwell

We understand USTs have been removed from the Brumfield-Twidwell site, and that Ecology is waiting for information regarding the location of those USTs and the results of the UST removal work performed at the site. We recommend reviewing reports of UST removal work to evaluate the likelihood of additional USTs that may still be present at the site. The Brumfield-Twidwell site may be a good candidate for a GPR survey, followed by direct-push borings if the survey detects additional suspect USTs. Direct-push borings could also be located in the permeable bedding material of the utility corridors immediately west of the site to evaluate the likelihood that contaminants are following preferential pathways.

We recommend the inside of the old gravity sewer system located under Pioneer Avenue, north of the Brumfield-Twidwell site be sampled for the presence of petroleum hydrocarbon contamination. Samples should be collected from locations within the pipeline where contaminant infiltration is suspected to be occurring.

4.3.2 GH Grange/Tony's Short Stop

More information is necessary regarding the contaminant source(s) at these sites. We recommend a GPR survey between the two sites to determine the likelihood of additional USTs that may be present at/between the sites. Additional direct-push borings between the two sites, especially in the permeable bedding material of the utility corridors, will provide additional information about the nature and extent of contamination at these sites.

We recommend the inside of the old gravity sewer system located on the east and south sides of Tony's, and north, west and south of the GH Grange sites be sampled for the presence of petroleum hydrocarbon contamination. Samples should be collected from locations within the pipeline where contaminant infiltration is suspected to be occurring.

4.3.3 Whitney's Inc./Key Bank (Sterling)

We recommend using GPR at the Whitney's Inc./Key Bank (Sterling) site to evaluate the potential presence of USTs. Additional direct-push borings could be advanced where the presence of USTs is suspected.

We recommend the inside of the old gravity sewer system located in the middle of the Whitney's Inc./ Key Bank (Sterling) site be sampled for the presence of petroleum hydrocarbon contamination. Samples should be collected from locations within the pipeline where contaminant infiltration is suspected to be occurring.

5.0 CONCLUSIONS

5.1 GENERAL

Explorations performed in the Project Area have identified three areas that have petroleum-related contamination at concentrations greater than the MTCA Method A cleanup levels. These areas include the Brumfield-Twidwell, GH Grange/Tony's Short Stop and Key Bank (Sterling)/Whitney's Inc. sites. Further exploration is necessary to define the nature and extent of contamination in these areas.

Information gathered from other areas that were evaluated as part of this exploration program indicated that contamination in these other areas is likely residual contamination remaining on site, or contamination that does not exceed the MTCA Method A cleanup levels. These areas include the Picco's/ Pontiac Richfield and Pinger's Texaco/Allison's sites.

The suspected regional contamination in the Project Area is likely the result of source areas remaining on the Brumfield-Twidwell, GH Grange/Tony's Short Stop and Key Bank (Sterling)/Whitney's Inc. sites. Potential preferential pathways along utility corridors were identified during development of the site conceptual model. Multiple borings were located as close as possible to utility corridors to assess the likelihood of those corridors acting as preferential migration pathways for contaminants. However, sampling of baseflow within these suspected preferential pathways was not performed as part of this exploration program.

We recommend that further evaluation of the nature and extent of the contamination at these three areas be completed to gain a better understanding of the source of the regional contamination. In addition, an evaluation of contaminant transport within potential pathways from these sites will need to be performed. Evaluation of transport pathways will consist of the following:

- Additional sampling of groundwater from permeable bedding materials in utility corridors adjacent to suspected source areas to more accurately evaluate to what extent these bedding materials function as a transport pathway for petroleum contamination.
- Sampling baseflow in storm drains and sanitary sewers to assess concentrations of BTEX and petroleum hydrocarbons that may be present in sewer flows.
- Sampling of flows at known discharge points into Smith Canal to evaluate if there are potential impacts to adjacent water bodies.

Concerns regarding indoor air quality exist at some properties in the Project Area, and additional information is required to assess if there is a potential risk to human health at these areas.

APPENDIX A
SAMPLING AND ANALYSIS PLAN

APPENDIX B
EXPLORATION LOGS

APPENDIX C
ANALYTICAL DATA QA/QC SUMMARY AND CHEMICAL ANALYTICAL DATA REPORTS

APPENDIX C
ANALYTICAL DATA QA/QC SUMMARY

1.0 INTRODUCTION

This document presents the findings of the analytical data quality review for the groundwater investigation in downtown Montesano. Analytical data in this report were screened to determine usability of results. This screening assumes analytical results are correct as reported and merely provides an interpretation of the reported quality control results. This review addresses soil samples collected between May 9, 2005 and May 16, 2005 by GeoEngineers, Inc. The soil samples were submitted to North Creek Analytical, Inc (NCA) in Bothell, Washington for chemical analysis. Fifty-seven (57) soil samples were analyzed by the following analytical methods:

- Petroleum hydrocarbons by NWTPH-HCID, NWTPH-G and EPA 8012B and NWTPH-Dx with acid/silica gel cleanup.

1.1 DATA EVALUATION CRITERIA

Data review was performed using guidance from *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review* (USEPA, 1999). The review included evaluation of holding times, method blanks, blank spike and matrix spike recoveries, surrogate recoveries (system monitoring compounds) and laboratory replicate data.

Data qualification was based on recommended actions in the guidance documents and professional judgment. Only the data with exceptions were described in further detail below.

2.0 TECHNICAL ASSESSMENT

Data were evaluated against the referenced criteria identified in Section 1.1. During the review, some analytical results were qualified. Qualifiers include:

- J = Estimated value

2.1 TEMPERATURE

The laboratory case narrative for samples submitted on May 16, 2005 indicated the coolers were received at temperatures greater (13.4 degrees Celsius) than the specified criteria [4 degrees Celsius (+/- 2 degrees)]. No specific guidance regarding temperature for soil was available. If we used the guidance available for water we would suggest qualifications, however, based on our review of the sample control history, the elevated temperature occurred during final transport to the analytical laboratory, and likely occurred for a short period of time (less than 3 hours). In our opinion, this temperature exceedance is considered to have an insignificant impact on sample integrity. Based on professional judgment, all petroleum results within the sample delivery group (SDG) B5E0488 were qualified as estimated, "J". The samples submitted to the laboratory on May 17, 2005 were received at a temperature within the specified criteria and were not qualified.

2.2 SURROGATE RECOVERIES

Surrogate recoveries were greater than specified criteria on three samples; SP-7-2-17, SP-10-3-15 and SP-26-1-0 from the NWTPH-G and EPA 8012B analyses. Surrogate recoveries were below than specified criteria

on one sample, SP-26-1-0, from the NWTPH-Dx analysis. The positive results from these samples were qualified as estimated, "J".

2.3 RELATIVE PERCENT DIFFERENCE

The relative percent difference (RPD) for the sample Duplicate (5E25055-DUP1) was slightly greater than the specified criteria. The associated quality control samples for this sample were within specified criteria. The samples were not qualified.

2.4 CONTINUING CALIBRATION

The laboratory case narrative for samples submitted on May 16, 2005 indicated the percent recoveries for gasoline-range hydrocarbons on the closing calibration after Samples SP-30-1-10 and SP-31-2-15 exceeded the established control limits. The elevated limits may be an indication of a biased high sample result, however, the sample results were non-detect and no additional qualifications were necessary.

3.0 ANALYTICAL DATA REVIEW SUMMARY

It is our opinion that the analytical data are of acceptable quality for their intended use based on our data quality review.

APPENDIX D
REPORT LIMITATIONS AND GUIDELINES FOR USE

APPENDIX D
REPORT LIMITATIONS AND GUIDELINES FOR USE[1]

This appendix provides information to help you manage your risks with respect to the use of this report.

ENVIRONMENTAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES, PERSONS AND PROJECTS

GeoEngineers has performed this Groundwater Investigation of the Downtown Montesano area in general accordance with the scope and limitations of our proposal, dated March 5, 2005. This report has been prepared for use by Washington Department of Ecology (Ecology). This report is not intended for use by others, and the information contained herein is not applicable to other sites.

GeoEngineers structures our services to meet the specific needs of our clients. For example, a groundwater investigation conducted in one location may not fulfill the needs of a prospective user of the same area. Because each environmental study is unique, each environmental report is unique, prepared solely for the specific client and project site. No one except Ecology should rely on this environmental report without first conferring with GeoEngineers. This report should not be applied for any purpose or project except the one originally contemplated.

THIS ENVIRONMENTAL REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

This report has been prepared for Ecology. GeoEngineers considered a number of unique, project-specific factors when establishing the scope of services for this project and report. Unless GeoEngineers specifically indicates otherwise, do not rely on this report if it was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

If important changes are made to the project or site after the date of this report, GeoEngineers should be retained to review our interpretations and recommendations and to provide written modifications or confirmation, as appropriate.

RELIANCE CONDITIONS FOR THIRD PARTIES

If a lending agency or other parties intend to place legal reliance on the product of our services, we require that those parties indicate in writing their acknowledgement that the scope of services provided, and the general conditions under which the services were rendered including the limitation of professional liability, are understood and accepted by them. This is to provide our firm with reasonable protection against open-ended liability claims by third parties with whom there would otherwise be no contractual limits to their actions.

[1] Developed based on material provided by ASFE, Professional Firms Practicing in the Geosciences; www.asfe.org.

HISTORICAL INFORMATION PROVIDED BY OTHERS

GeoEngineers makes no warranties or guarantees regarding the accuracy or completeness of information provided or compiled by others. The information presented in this report is based on the above-described research and several site visits. GeoEngineers has relied upon information provided by others in our description of historical conditions and in our review of regulatory databases and files. The available data do not provide definitive information with regard to all past uses, operations or incidents at the site or adjacent properties.

UNCERTAINTY REMAINS EVEN AFTER THIS GROUNDWATER INVESTIGATION STUDY IS COMPLETED

No Groundwater Investigation can wholly eliminate uncertainty regarding the potential for contaminants of concern (COCs) in connection with a property. Performance of a Groundwater Investigation study is intended to provide information regarding the potential for COCs in connection with a property. There is always a potential that areas with contamination that were not identified during this Groundwater Investigation exist at the site or in the Project Area. Further evaluation of such potential would require additional research, subsurface exploration, sampling and/or testing.

ENVIRONMENTAL REGULATIONS ARE ALWAYS EVOLVING

Some substances may be present in the site vicinity in quantities or under conditions that may have led, or may lead, to contamination of the subject site, but are not included in current local, state or federal regulatory definitions of hazardous substances or do not otherwise present current potential liability. GeoEngineers cannot be responsible if the standards for appropriate inquiry, or regulatory definitions of hazardous substance, change or if more stringent environmental standards are developed in the future.

SITE CONDITIONS CAN CHANGE

This environmental report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time by events such as a change in property use or occupancy, or by natural events, such as floods, earthquakes, slope instability or ground water fluctuations. Always contact GeoEngineers before applying this report so that GeoEngineers may evaluate reliability of the report to changed conditions.

READ THESE PROVISIONS CLOSELY

Some clients, design professionals and contractors may not recognize that the geoscience practices (geotechnical engineering, geology and environmental science) are far less exact than other engineering and natural science disciplines. This lack of understanding can create unrealistic expectations that could lead to disappointments, claims and disputes. GeoEngineers includes these explanatory "limitations" provisions in our reports to help reduce such risks. Please confer with GeoEngineers if you are unclear how these "Report Limitations and Guidelines for Use" apply to your project or site.

GEOTECHNICAL, GEOLOGIC AND ENVIRONMENTAL REPORTS SHOULD NOT BE INTERCHANGED

The equipment, techniques and personnel used to perform an environmental study differ significantly from those used to perform a geotechnical or geologic study and vice versa. For that reason, a geotechnical engineering or geologic report does not usually relate any environmental findings, conclusions or recommendations; e.g., about the likelihood of encountering underground storage tanks or

regulated contaminants. Similarly, environmental reports are not used to address geotechnical or geologic concerns regarding a specific project.

BIOLOGICAL POLLUTANTS

GeoEngineers' Scope of Work specifically excludes the investigation, detection, prevention, or assessment of the presence of Biological Pollutants in or around any structure. Accordingly, this report includes no interpretations, recommendations, findings, or conclusions for the purpose of detecting, preventing, assessing, or abating Biological Pollutants. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria, and viruses, and/or any of their byproducts.